GSX20N70E

MOSFET

Metal Oxide Semiconductor Field Effect Transistor

Super Junction MOSFET

700V Super Junction Power Transistor

GSX20N70E

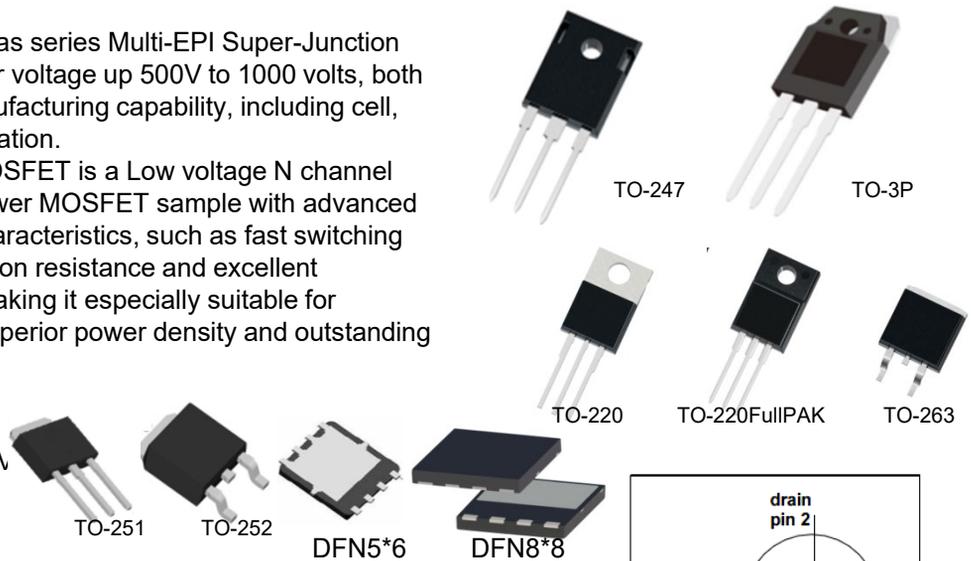Data Sheet

Ver 0.2

2018-5-20

700V 20A Power MOSFET

■ Description

Group Semiconductor(GS) has series Multi-EPI Super-Junction power MOSFET platforms for voltage up 500V to 1000 volts, both with design service and manufacturing capability, including cell, termination design and simulation.

The GS 700V 20A power MOSFET is a Low voltage N channel Multi-EPI Super-Junction power MOSFET sample with advanced technology to have better characteristics, such as fast switching time, low Ciss and Crss, low on resistance and excellent avalanche characteristics, making it especially suitable for applications which require superior power density and outstanding efficiency.
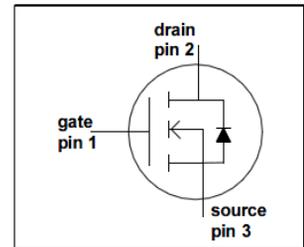
TO-247   TO-3P

TO-220   TO-220FullPAK   TO-263

■ Features

RDS(ON)=0.21Ω @VGS = 10V
VDS = 700V
ID (@ VGS=10V) = 10A

TO-251   TO-252

DFN5*6   DFN8*8

drain
pin 2

gate
pin 1

source
pin 3

■ PKG

GSA20N70E	GSP20N70E	GSB20N70E	GSD20N70E	GSS20N70E
TO-220Fullpak	TO-220	TO-263	TO-252	TO-251
GSW20N70E	GSJ20N70E	GSN20N70E	GSM20N70E	
TO-247	TO-3P	DFN5*6	DFN8*8	

■ Absolute Maximum Ratings (TC = 25° C, unless otherwise specified)

Symbol	Parameter	GSP20N70E	GSA20N70E	Unit
V_{DSS}	Drain-Source Voltage	700		V
I_D	Drain Current -Continuous (TC = 25℃) -Continuous (TC = 100℃)	20* 12*		A
I_{DM}	Drain Current - Pulsed (Note 1)	48		A
V_{GSS}	Gate-Source voltage	±30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	485		mJ
I_{AR}	Avalanche Current (Note 1)	3.5		A
E_{AR}	Repetitive Avalanche Energy (Note 1)	1		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	15		V/ns
dVds/dt	Drain Source voltage slope (Vds=480V)	50		V/ns
P_D	Power Dissipation (TC = 25℃)	151	35	W
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150		℃
T_L	Max. Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300		℃

700V 22A Power Transistor

■ Electrical Characteristics (TJ=25°C unless otherwise specified)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV$_{DSS}$	Drain-Source Breakdown Voltage	V$_{GS}$ = 0V, I$_D$ = 250µA, T$_J$ = 25℃	700	--	--	V
		V$_{GS}$ = 0V, I$_D$ = 250µA, T$_J$ = 150℃	--	750	--	V
ΔBV$_{DSS}$/ΔT$_J$	Breakdown Voltage Temperature Coefficient	I$_D$ = 250µA, Referenced to 25℃	--	0.6	--	V/℃
I$_{DSS}$	Zero Gate Voltage Drain Current	V$_{DS}$ = 700V, V$_{GS}$ = 0V -T$_J$=25 ℃ -T$_J$ = 150℃	--	-- 10	1 -	µA µA
I$_{GSSF}$	Gate-Body Leakage Current, Forward	V$_{GS}$ = 30V, V$_{DS}$ = 0V	--	--	100	nA
I$_{GSSR}$	Gate-Body Leakage Current, Reverse	V$_{GS}$ = -30V, V$_{DS}$ = 0V	--	--	-100	nA
On Characteristics						
V$_{GS(th)}$	Gate Threshold Voltage	V$_{DS}$ = V$_{GS}$, I$_D$ = 250µA	2	--	4	V
R$_{DS(on)}$	Static Drain-Source On-Resistance	V$_{GS}$ = 10V, I$_D$ = 10A	--	0.19	0.21	Ω
g$_{FS}$	Forward Transconductance	V$_{DS}$ = 40V, I$_D$ = 10A	--	16	--	S
Dynamic Characteristics						
C$_{iss}$	Input Capacitance	V$_{DS}$ = 25V, V$_{GS}$ = 0V, f = 1.0MHz	--	1410	-	pF
C$_{oss}$	Output Capacitance		--	70	-	pF
C$_{rss}$	Reverse Transfer Capacitance		--	5	--	pF
Switching Characteristics						
t$_{d(on)}$	Turn-On Delay Time	V$_{DD}$ = 520V (Note 4)	--	25	--	ns
t$_r$	Turn-On Rise Time		--	17	--	ns
t$_{d(off)}$	Turn-Off Delay Time		--	130	--	ns
t$_f$	Turn-Off Fall Time		--	11	--	ns
Q$_g$	Total Gate Charge	V$_{DS}$ = 560V, I$_D$ = 11A V$_{GS}$ = 10V (Note 4)	--	90	120	nC
Q$_{gs}$	Gate-Source Charge		--	8.5	--	nC
Q$_{gd}$	Gate-Drain Charge		--	13	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I$_S$	Maximum Continuous Drain-Source Diode Forward Current		--	--	20	A
I$_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current		--	--	60	A
V$_{SD}$	Drain-Source Diode Forward Voltage	V$_{GS}$ = 0V, I$_S$ = 11A	--	0.9	1.5	V
t$_{rr}$	Reverse Recovery Time	V$_{GS}$ = 0V, I$_S$ = 11A	--	475	--	ns
Q$_{rr}$	Reverse Recovery Charge	dI$_F$/dt =100A/µs	--	5.8	--	µC

NOTES:
1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L=60mH, I$_{AS}$=3A, VDD=150V, Starting TJ=25 ℃
3. I$_{SD}$≤4.5A, di/dt ≤ 200A/us, V$_{DD}$ ≤ BV$_{DSS}$, Starting TJ = 25 ℃
4. Pulse Test: Pulse width ≤ 300us, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

■Thermal Characteristics

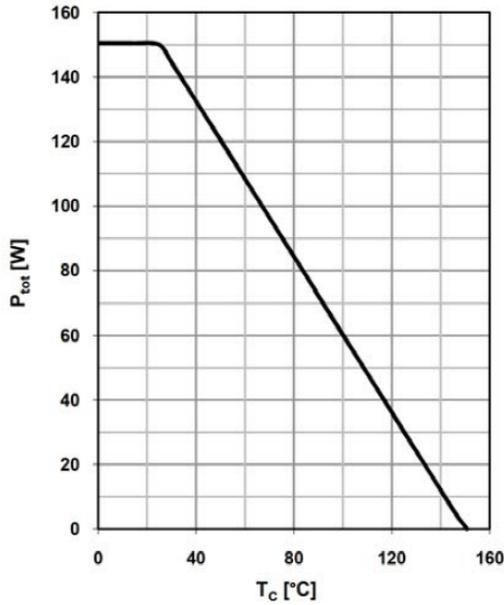| Symbol	Parameter	GSA20N70E	GSP20N70E	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.2	1.2	℃/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	0.5	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62	62	℃/W

Symbol	Parameter	Value (TO220)	Unit
$R_{\theta JA}$ [6]	Maximum Junction-to-Ambient	82	℃/W
$R_{\theta CS}$ [6]	Maximum Case-to-sink	0.6	℃/W
$R_{\theta JC}$ [7],[8]	Maximum Junction-to-Case θ	4.1	℃/W

1. The power dissipation PD is based on TJ(MAX)=150°C in a TO251 package, using junction-to-case thermal resistance.
2. Repetitive rating, pulse width limited by junction temperature TJ(MAX)=150°C.
3. L=1mH, Starting TJ=25°C.
4. L = 10mH, starting TJ = 25°C.
5. L=60mH, starting TJ = 25°C.
6. The tests are performed with the device with T A =25°C.
7. The R □ JA is the sum of the thermal impedance from junction to case R □ JC and case to ambient.
8. These curves are based on the junction-to-case thermal impedance, assuming a maximum junction temperature of TJ(MAX)=150°C.

Typical Performance Characteristics

Power dissipation Non FullPAK	Power dissipation FullPAK
$P_{tot} = f(T_C)$	$P_{tot} = f(T_C)$
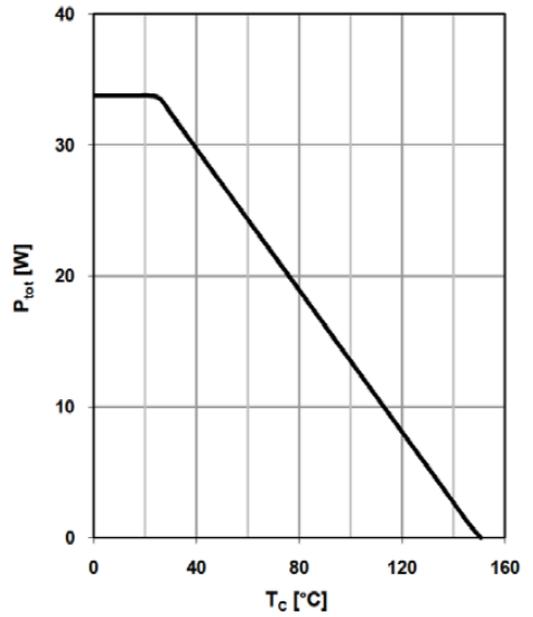
Max. transient thermal impedance Non FullPAK	Max. transient thermal impedance FullPAK
$Z_{(thJC)}=f(tp)$; parameter: D=t_p/T	$Z_{(thJC)}=f(tp)$; parameter: D=t_p/T
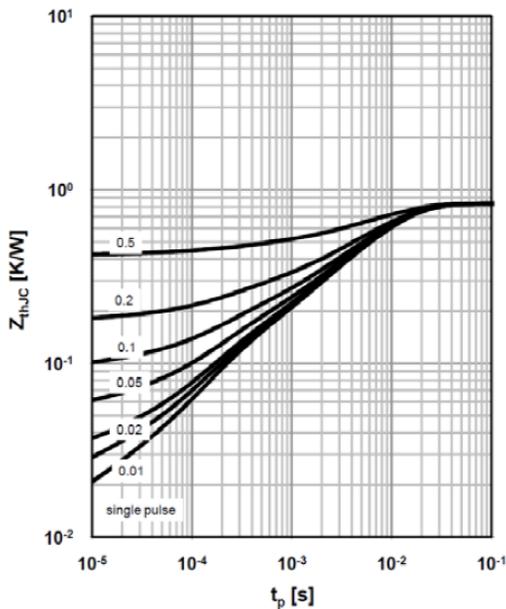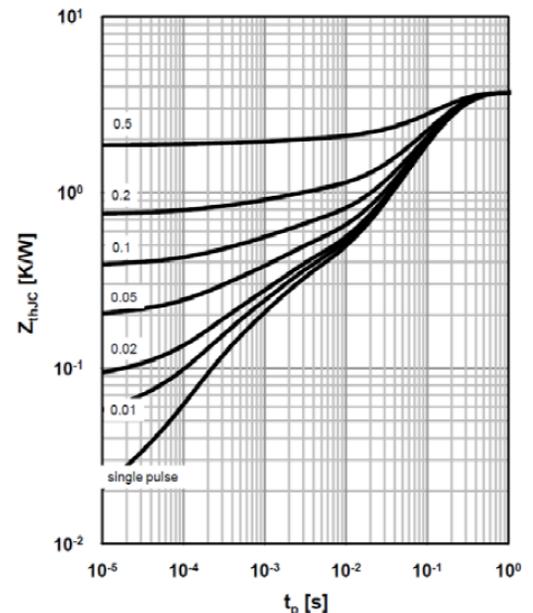
Typical Performance Characteristics

Power dissipation TO-220, TO-247, TO-262, TO-263	Power dissipation TO-220 FullPAK
$P_{tot} = f(T_C)$	$P_{tot} = f(T_C)$
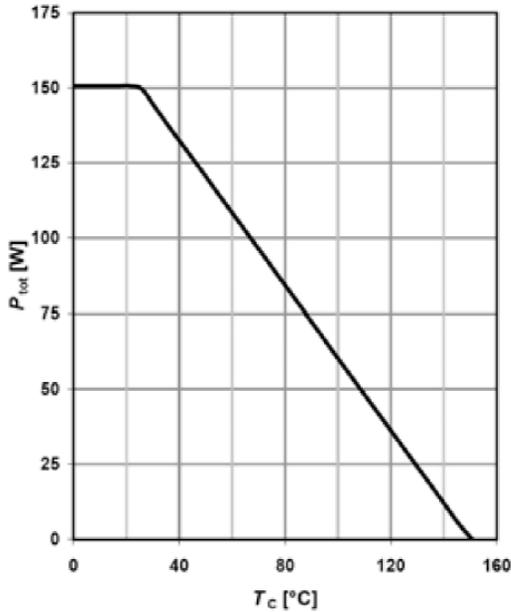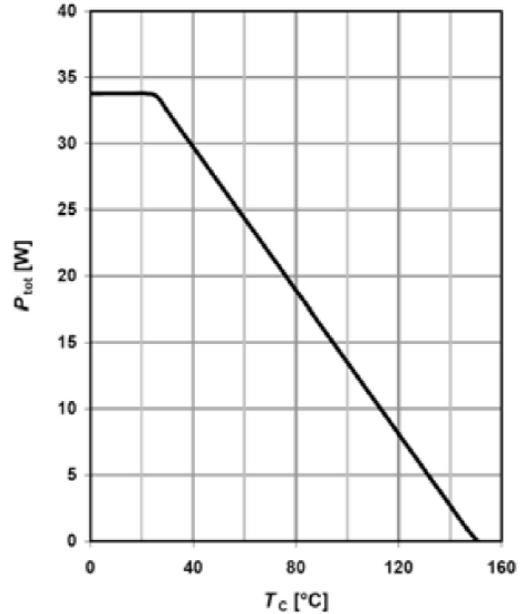
Max. transient thermal impedance TO-220, TO-247, TO-262, TO-263	Max. transient thermal impedance TO-220 FullPAK
$Z_{(thJC)}=f(tp)$; parameter: $D=t_p/T$	$Z_{(thJC)}=f(tp)$; parameter: $D=t_p/T$
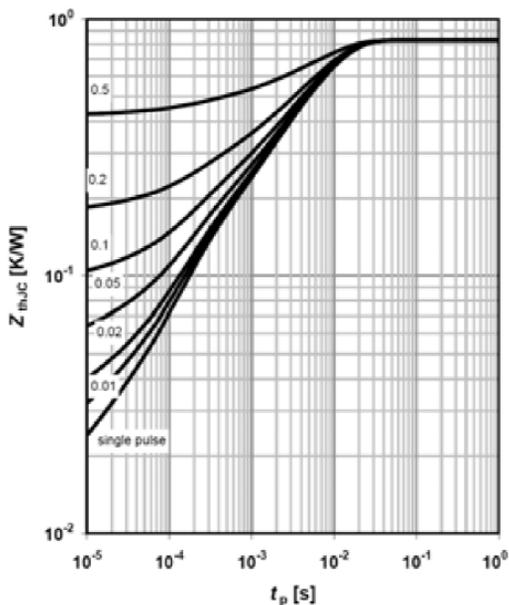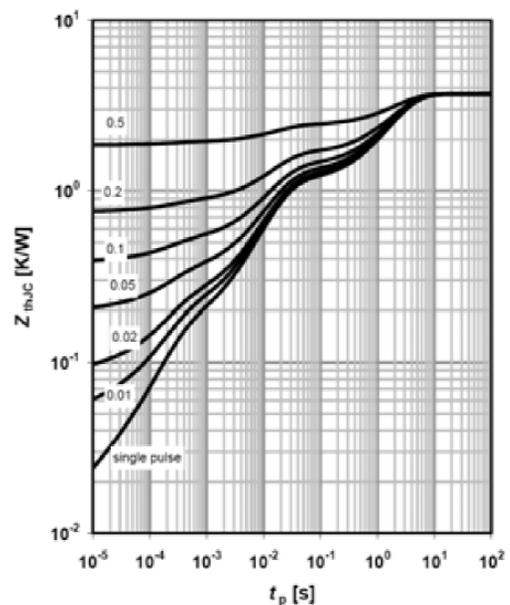
Typical Performance Characteristics

Safe operating area T_C=25 °C TO-220, TO-247, TO-262, TO-263	Safe operating area T_C=25 °C TO-220 FullPAK
I_D=f(V_{DS}); T_C=25 °C; D=0; parameter t_p	I_D=f(V_{DS}); T_C=25 °C; D=0; parameter t_p
Safe operating area T_C=80 °C TO-220, TO-247, TO-262, TO-263	Safe operating area T_C=80 °C TO-220 FullPAK
I_D=f(V_{DS}); T_C=80 °C; D=0; parameter t_p	I_D=f(V_{DS}); T_C=80 °C; D=0; parameter t_p
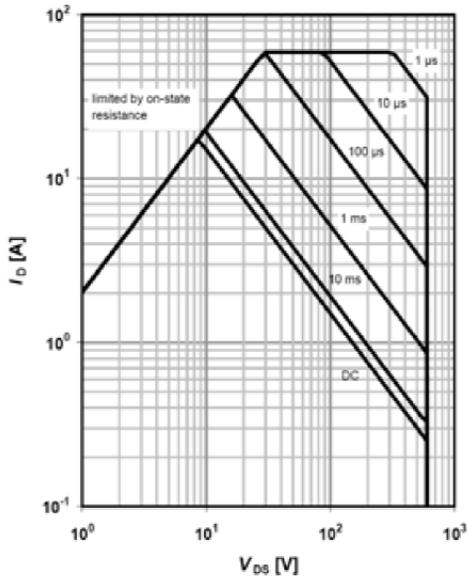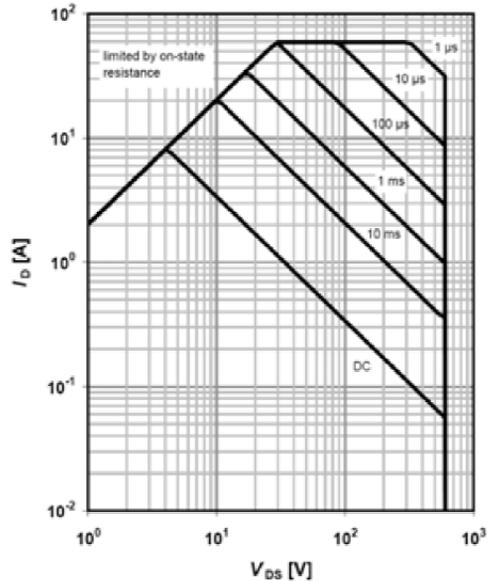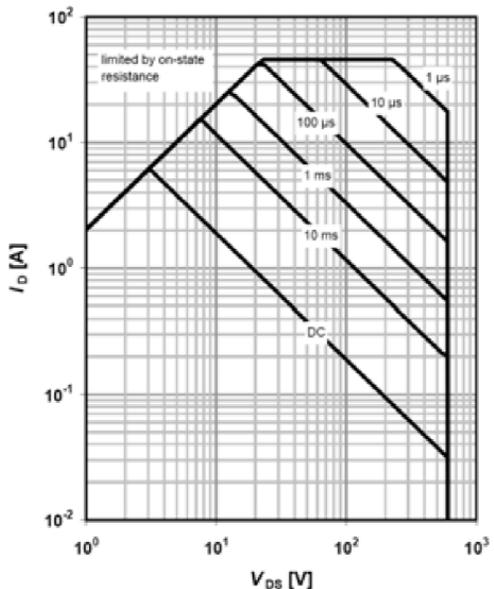
Typical Performance Characteristics

Diagram 7: Typ. drain-source on-state resistance	Diagram 8: Drain-source on-state resistance
$R_{DS(on)}$=f(I_D); T_j=125 °C; parameter: V_{GS}	$R_{DS(on)}$=f(T_j); I_D=3.0 A; V_{GS}=10 V
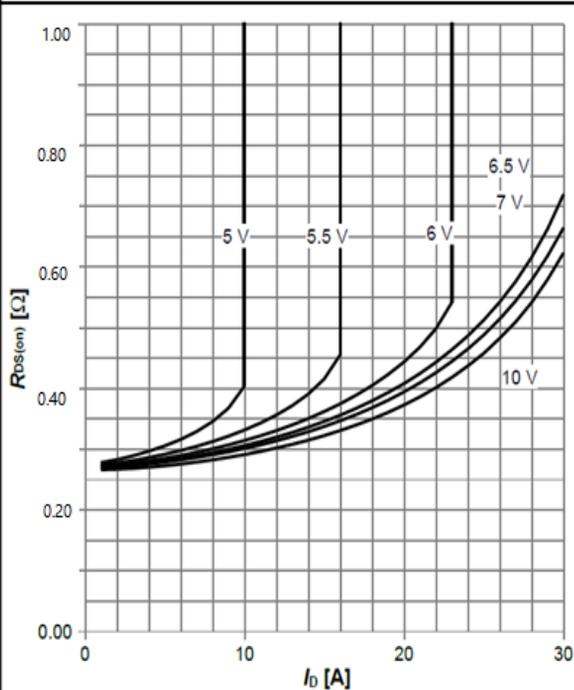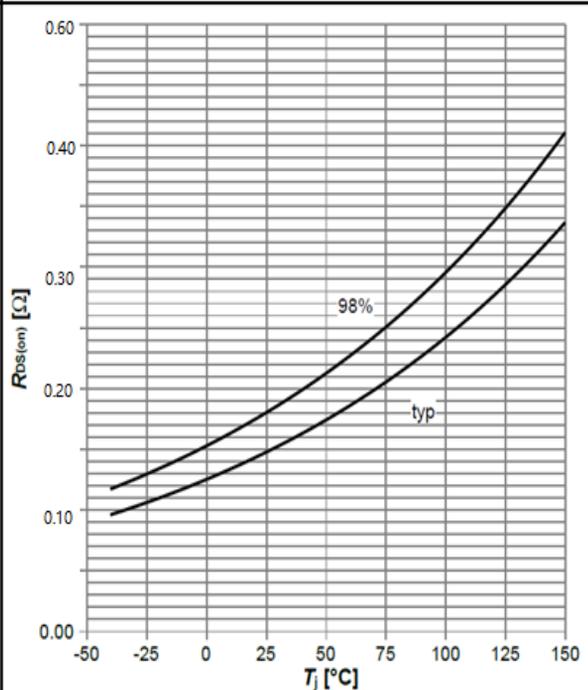
Typ. output characteristics T_c=25 °C	Typ. output characteristics T_j=125 °C
I_D=f(V_{DS}); T_j=25 °C; parameter: V_{GS}	I_D=f(V_{DS}); T_j=125 °C; parameter: V_{GS}
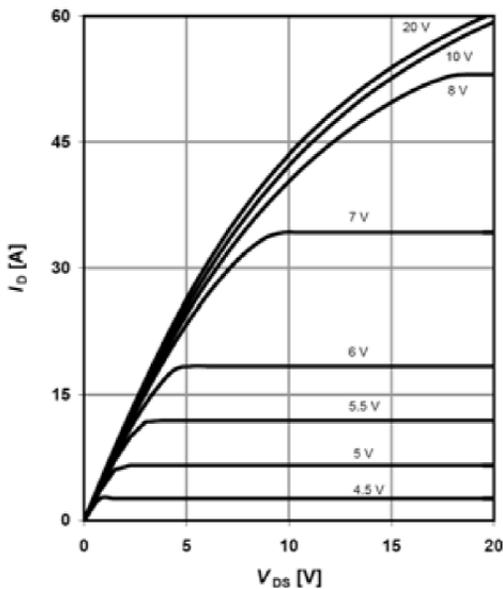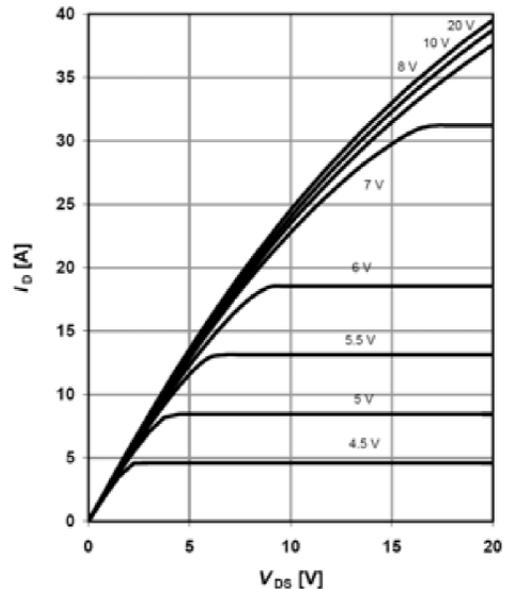
Typical Performance Characteristics

Diagram 11: Forward characteristics of reverse diode
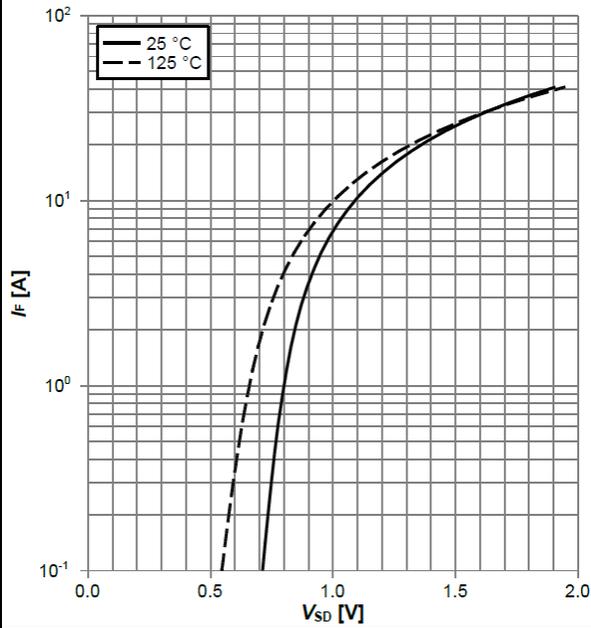
Diagram 13: Drain-source breakdown voltage

$I_F=f(V_{SD})$; parameter: T_j
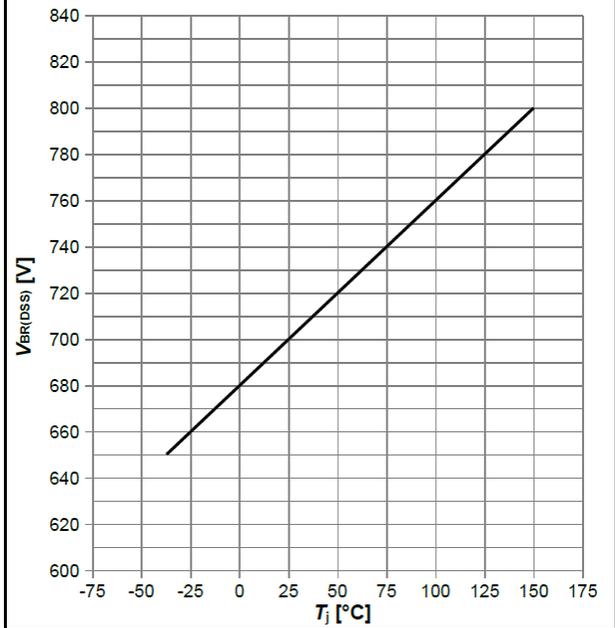
$V_{BR(DSS)}=f(T_j)$; $I_D=1$ mA

Typ. transfer characteristics
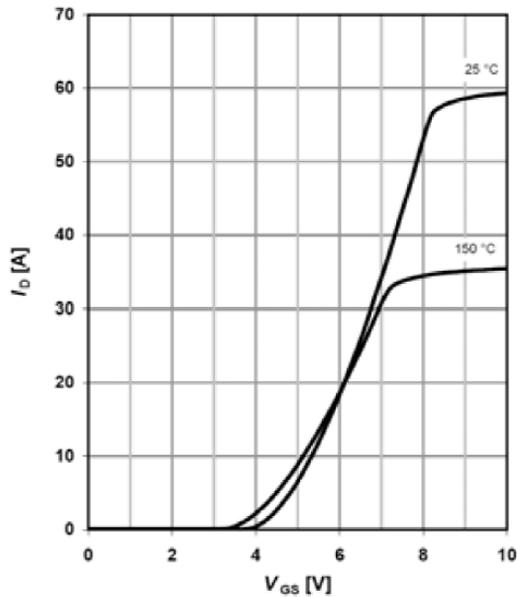
Typ. gate charge

$I_D=f(V_{GS})$; $V_{DS}=20V$
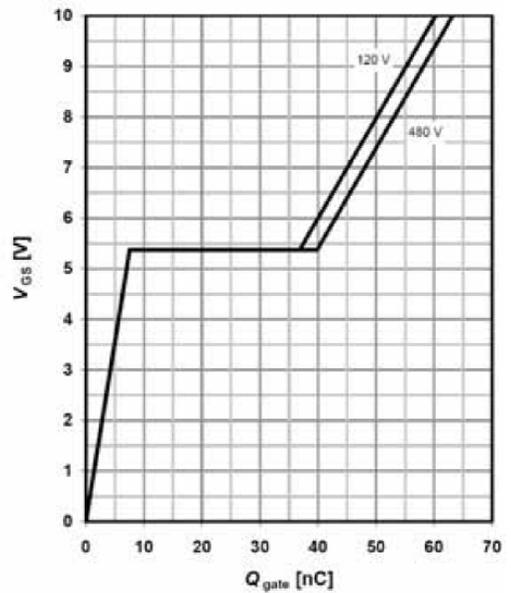
$V_{GS}=f(Q_{gate})$, $I_D=9.5A$ pulsed

Table 20   Switching times test circuit and waveform for inductive load

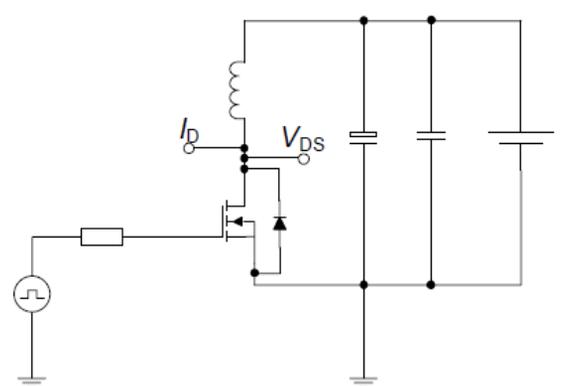| Switching times test circuit for inductive load	Switching time waveform
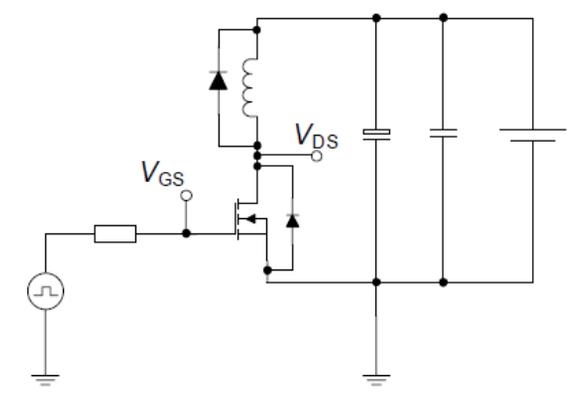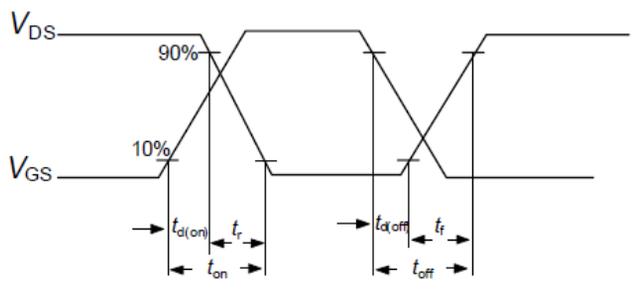
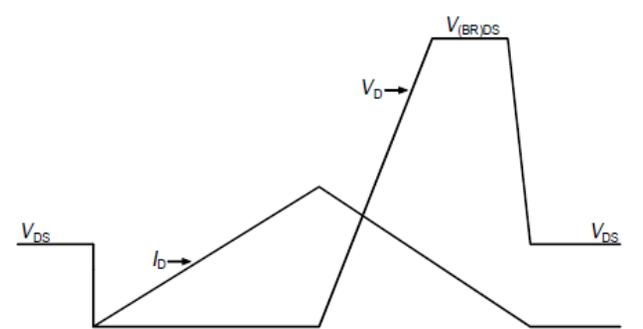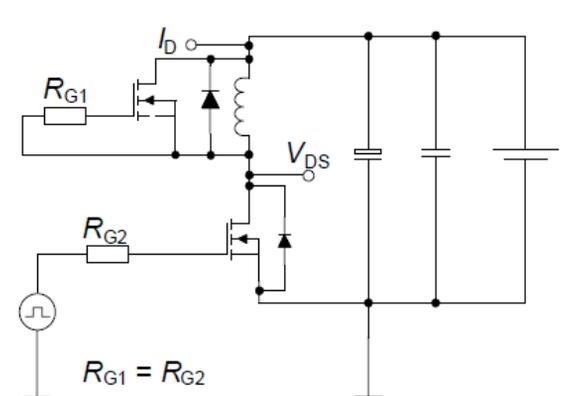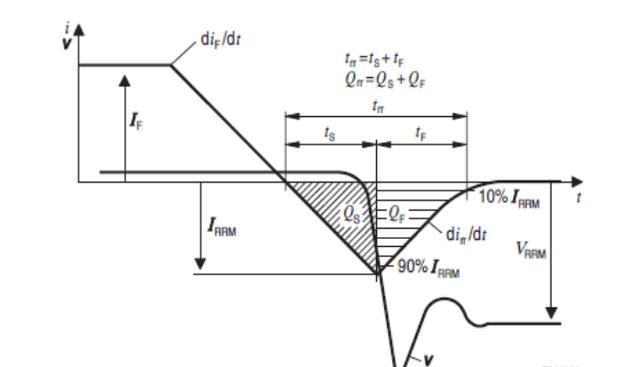**Table 21   Unclamped inductive load test circuit and waveform**

Unclamped inductive load test circuit	Unclamped inductive waveform

Table 22   Test circuit and waveform for diode characteristics

Test circuit for diode characteristics	Diode recovery waveform